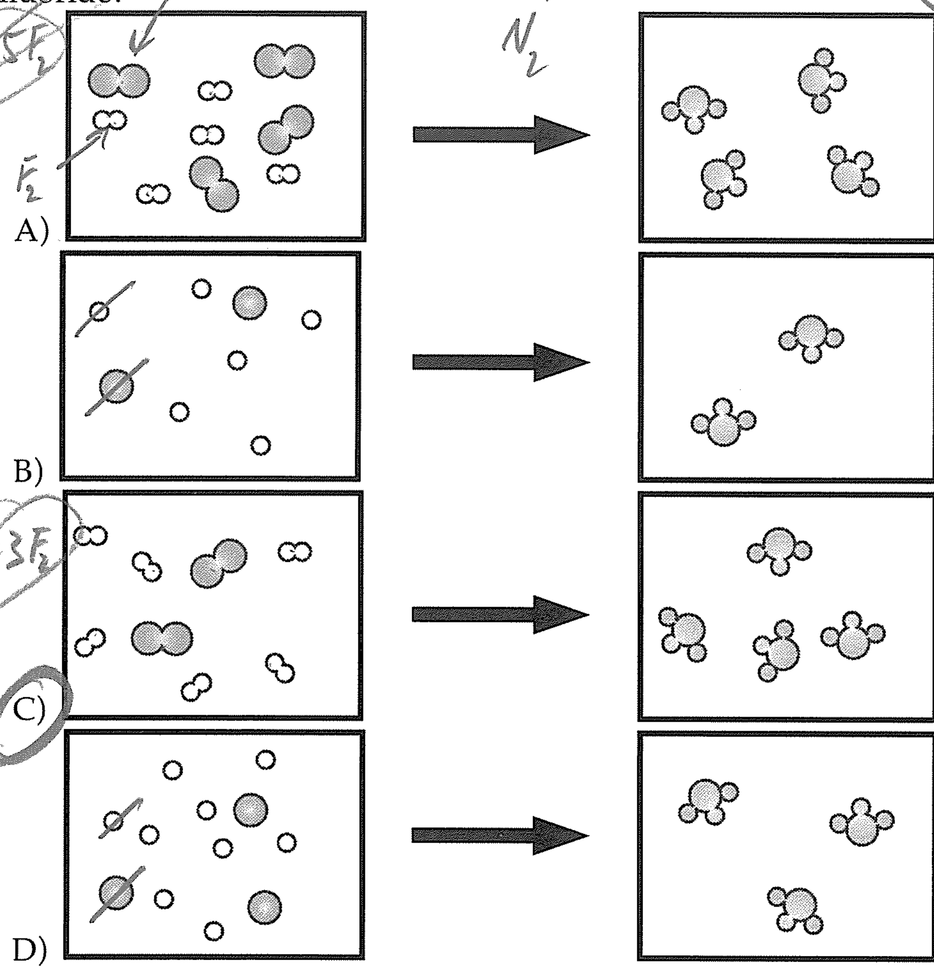
Ch. 3&4 Review

1) Nitrogen trifluoride is a potent greenhouse gas that is used in the manufacture of semiconductors. It can be produced from nitrogen and fluorine gas by electric discharge. Which of the diagrams below best represents the formation of nitrogen trifluoride?



$$MnO_4^- + 5Fe^{2+} + 8H^+ \longrightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

2) In the reaction represented above, the number of MnO4– ions that react must be equal to which of the following?

A) One-fifth the number of Fe^{2+} ions that are consumed
B) Eight times the number of H^+ ions that are consumed
C) Five times the number of Fe^{3+} ions that are produced
D) One-half the number of H_2O molecules that are produced

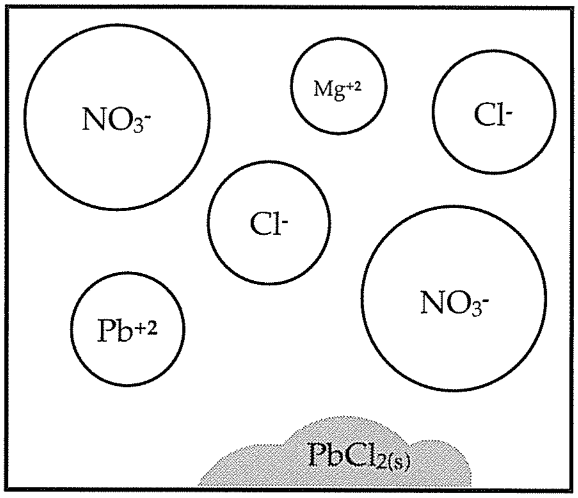
Need Pb^{2+} ions

$$Pb(NO_3)_{2(aq)} + MgCl_{2(aq)} \longrightarrow PbCl_{2(s)} + Mg(NO_3)_{2(aq)}$$

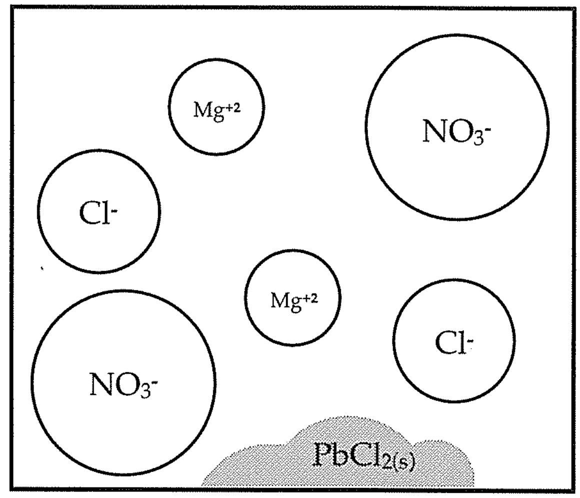
3) A student combines <u>excess</u> $Pb(NO_3)_{2(aq)}$ with a dilute solution of $MgCl_{2(aq)}$ to form $PbCl_{2(s)}$, as shown above. Which of the diagrams below best depicts the contents of the container after the reaction has run to completion?

no Cl^-

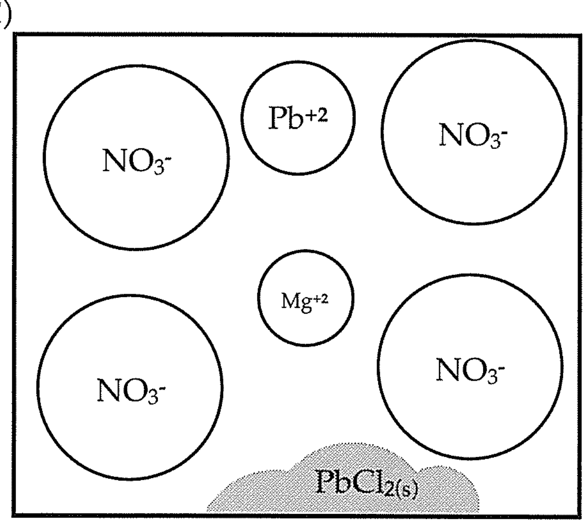
A)



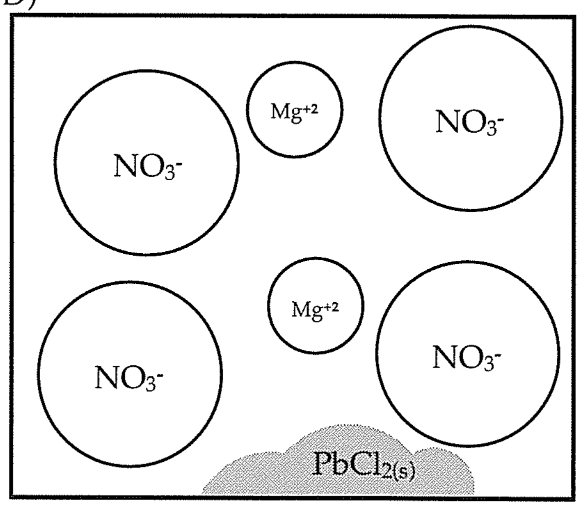
B)



C)



D)



4) A 23.0 g sample of a compound contains 12.0 g of C,3.0g of H,and 8.0g of O. Which of the following is the empirical formula of the compound?

A) CH_3O

B) C_2H_6O

C) $C_3H_9O_2$

D) $C_4H_{12}O_2$

12g C · 1M/12g = 1mol C / .5 = 2   8g O · 1mol/16g = .5 mol O

3.0g H · 1mol/1g = 3 mol H / .5 = 6 C_2H_6O

$$AgNO_{3(aq)} + NaCl_{(aq)} \longrightarrow AgCl_{(s)} + NaNO_{3(aq)}$$

5) A student performed an analysis to determine the amount of $AgNO_{3(aq)}$ in a solution. Excess $NaCl_{(aq)}$ was added to the solution, and the $Ag^{+}_{(aq)}$ precipitated as $AgCl_{(s)}$. The precipitate was collected by gravity filtration and dried in an oven. Three trials were performed, and in each case, according to the instructor, the mass of precipitate recovered was 5 percent higher than the actual mass of $AgCl_{(s)}$ that should have formed. Which of the following could account for the error?

A) The pores in the filter paper were too large. ← lose mass

B) Not all of the precipitate was transferred to the filter paper. ← lose mass

C) The $NaCl_{(aq)}$ solution was too concentrated. ← ? no change

D) The precipitate was not rinsed with deionized water before drying.

↑ This would leave extra ions behind

1a) $3AgNO_3 + MCl_3 \rightarrow 3AgCl + M(NO_3)_3$

b) $2.49g\ AgCl \cdot \frac{1\,mol\ AgCl}{143.35g\ AgCl} \cdot \frac{1\,Cl}{1\,AgCl} \cdot \frac{35.45g\,Cl}{1\,mol\,Cl} = 0.616g\,Cl$

$100 \cdot \frac{0.616g\,Cl}{1.65g\ total} = 37.3\%\,Cl$

c) $0.616g\,Cl \cdot \frac{1\,mol\,Cl}{35.45g\,Cl} \cdot \frac{1\,M}{3\,Cl} = 0.00579\,mol\,M$

$1.65 - 0.616g\,Cl = 1.034g\,M$

$\frac{1.034g\,M}{0.00579\,mol\,M} = 178.6\,g/mol\ M$

2a) #1 $\frac{0.756g\,H_2O}{1.762g\ total} \cdot 100 = 42.9\%$ #2 $\frac{0.691g}{1.351g} \cdot 100 = 51.1\%$ #3 $\frac{0.559}{1.097g} = 51.0\%$

b) ~51.0%, Trials 2+3 have a higer % and are very close together this indicates that all the water was driven off, while trial #1 the % of water was much lower indicating that not all the water was evaporated.

c) The % of water lost stays the same.

d) $51.0g\ H_2O \cdot \frac{1\,mol\,H_2O}{18.0g} = \frac{2.83}{0.407} = 7$

$49.0g\ MgSO_4 \cdot \frac{1\,mol\,MgSO_4}{120.37g\,MgSO_4} = \frac{0.407}{0.407} = 1$

$MgSO_4 \cdot 7H_2O$

(4) a) $(0.0445 \cdot 50) + (0.8379 \cdot 52) + (0.0950 \cdot 53) + (0.0237 \cdot 54)$

52.1 g/mol

$4Cr + 3O_2 \rightarrow 2Cr_2O_3$

bi) $5.72\,g\,Cr \cdot \frac{1\,mol\,Cr}{52.1\,g\,Cr} \cdot \frac{2\,mol\,Cr_2O_3}{4\,mol\,Cr} \cdot \frac{152\,g\,Cr_2O_3}{1\,mol\,Cr_2O_3} = 8.34\,g\,Cr_2O_3$

bii) $5.72\,g\,Cr \cdot \frac{1\,mol\,Cr}{52.1\,g\,Cr} \cdot \frac{3\,mol\,O_2}{4\,mol\,Cr} \cdot \frac{32.0\,g\,O_2}{1\,mol\,O_2} = 2.63\,g\,O_2$

(5) a) $3Ca(NO_3)_{2(aq)} + 2K_3PO_{4(aq)} \rightarrow Ca_3(PO_4)_{2(s)} + 6KNO_{3(aq)}$

$3Ca^{2+} + 2PO_4^{-3} \rightarrow Ca_3(PO_4)_{2(s)}$

bi) Ca^{2+} $.5\,L \cdot 0.750\,M = 0.375\,mol\,Ca(NO_3)_2$

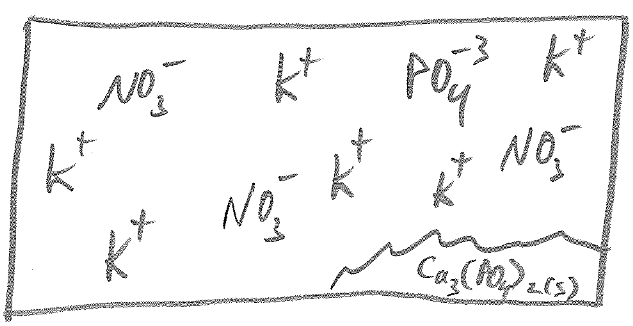
PO_4^{-3} $.5\,L \cdot 0.750\,M = 0.375\,mol\,K_3PO_4$

$0.375\,mol\,Ca(NO_3)_2 \cdot \frac{2\,K_3PO_4}{3\,Ca(NO_3)_2} = 0.250\,mol\,K_3PO_4$ needed

$Ca(NO_3)_2$ is limiting

bii) $0.375\,mol\,Ca(NO_3)_2 \cdot \frac{1\,Ca_3(PO_4)_2}{3\,Ca(NO_3)_2} \cdot \frac{310.18\,g\,Ca_3(PO_4)_2}{1\,mol\,Ca_3(PO_4)_2} = 38.8\,g\,Ca_3(PO_4)_2$

biii)



6a) $HF + NaOH \rightarrow H_2O + NaF$

$M_aV_a = M_bV_b \quad M_a = \frac{0.800M \cdot 15.5mL}{22.5mL} = 0.551M\ HF$

bi) $0.125M \cdot 0.100L = 0.0125mol\ HF$

$V = \frac{0.0125mol}{0.551M} = 0.0227L$ or $22.7mL$

bii) ① measure out 22.7mL of 0.551M HF

② put the 22.7mL in a 100mL volumetric flask

③ Fill the volumetric flask to the 100mL mark with water.

7a) $3.1g\ H_2O \cdot \frac{1mol\ H_2O}{18.02g} \cdot \frac{1O}{1H_2O} \cdot \frac{16.00g\ O}{1mol\ O} = 2.75g\ O$

$7.6g\ CO_2 \cdot \frac{1mol}{44.01g} \cdot \frac{2O}{1CO_2} \cdot \frac{16.0g\ O}{1mol\ O} = 5.53g\ O$

(+) → $8.28g\ O$

3.1 − 2.75 ↓

b) $0.35g\ H \cdot \frac{1mol\ H}{1.008g\ H} = \frac{0.35mol\ H}{0.172mol} = 2.0\ H$ $\quad CH_2$

7.6 − 5.53 ↓

$2.07g\ C \cdot \frac{1mol\ C}{12.01g\ C} = \frac{0.172mol\ C}{0.172mol} = 1C$

c) $\frac{58.12g/mol}{14.03g/mol} = 4.1 \approx 4$ $\boxed{C_4H_8}$

$CH_2 \rightarrow$ 14.03 g/mol